

STEPKEYS: A QWERTY Foot Keyboard



Shaurya Patni (CEO), Max Grisanti (CTO), Vasu Lakshmanan (CIO), Rishi Patel (CMO)

Advisor: Kevin Crowthers, Ph.D.

WPI Faculty Support: Ulkuhan Guler, Ph.D.

Problem Statement

While **typing** seems second nature to most, it can be extremely **difficult** or even impossible for individuals suffering from **hand mobility issues** or those **without hands** (“Arthritis,” 2023).

Engineering Goal

A **foot keyboard** that accommodates their **mobility limitations** and enables efficient keyboard functionality with the **user’s feet**.

Methodology

1. Design Drawings
Initial designs were **sketched** and used to **brainstorm** device functionality.

2. Prototype
Proof-of-concepts were created using materials in school to **visualize** the final product.

3. CAD Designs
CAD models were developed for **3D-printed parts** to build the final design.

4. Final Design
Our final design was built with **metal, wires, Arduino, and 3D-printed parts**.

Requirements

Level (most important to least)	Requirement Type	Requirement Statement
1	Functional	The design must have functional keys
1	Physical Functional	The design must be durable
1	Physical Functional	The design cannot allow user to sustain injury easily
1	Physical Functional	The design cannot be uncomfortable
1	Physical	The design must allow the user to rest their feet in order to have some breaks
1	Physical Functional	The design must have keys large enough so that the user can distinguish each individual key
1	Functional	The keyboard must support wireless connectivity to remove the need of cables
2	Functional	The design must be suitable for everyday environments such as a workplace or home
2	Cost	The design must not be more expensive than \$150
2	Physical	The design cannot be heavy
2	Physical Functional	The design must not allow for accidental typos due to small spacing
2	Physical	The design may add anti-slip materials/features to allow for stability and prevent the keyboard from moving during use
3	Physical	The design should allow for adjustable height and angle accomadation for different users
3	Appearance	The design should be aesthetically pleasing
3	Physical	The design can minimize noise produced during typing to have a quiet environment

Current Design

Multi-Part Keyboard Setup



Figure 1: Current Ergonomic Design (Physical Prototype #2)

- **Versatile** key configurations
- **Multipurpose** functionality for keys
- **Angular** tilt for increased ease of use
- **Optimal** utilization of space
- **Dynamic** sizing of the keys

Design 2

ErgoFlex Multi-Function Keyboard



Figure 2: Proof of Concept of the ErgoFlex Multi-Function Keyboard

- **Less** keys
- **Bigger** keys
- **Learning** curve

Design 3

Multi-Part Keyboard Setup

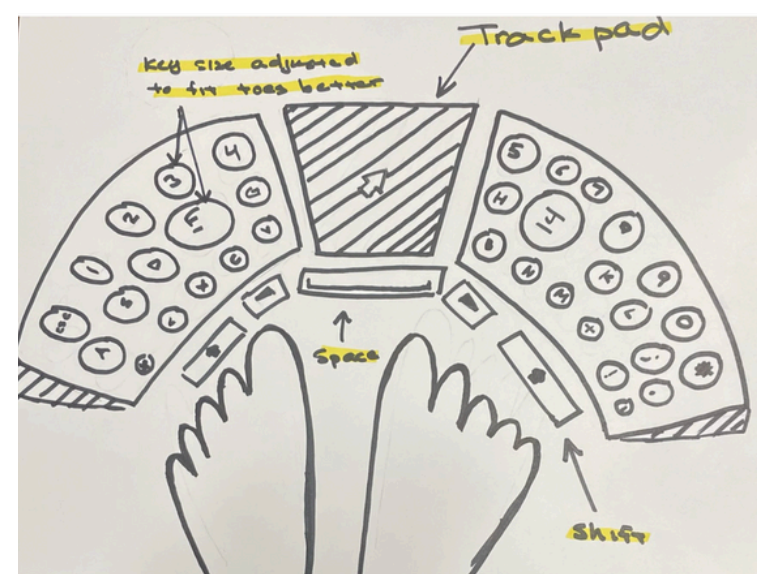


Figure 3: Sketch of Multi-Part Keyboard Setup

- **Includes** trackpad
- **Keys spread** apart

Design 4

One-Part Keyboard Setup

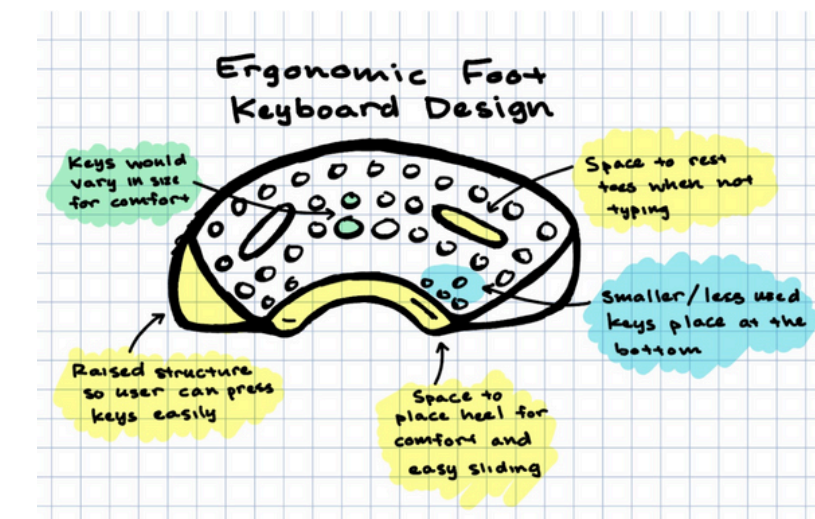


Figure 4: Sketch of One-Part Keyboard Setup

- **Foot rest**
- **Elevated**
- **Large** quantity of keys

Design Studies

Design Study 1: Timed Typing

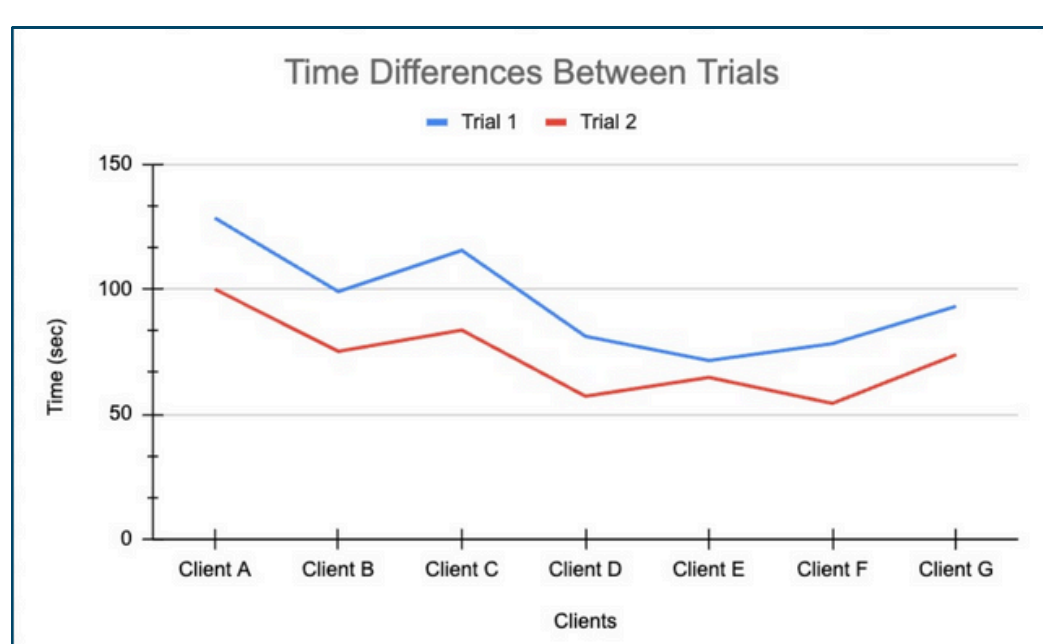


Figure 5: Change in speed between trials

In this study, clients were **timed** as they **typed** “The quick brown fox jumps over the lazy dog” using the keyboard. This process was **repeated twice**, and it was found that all users were able to **quickly adapt** to the keyboard and **improve their speed**.

Design Study 2: Errors While Typing

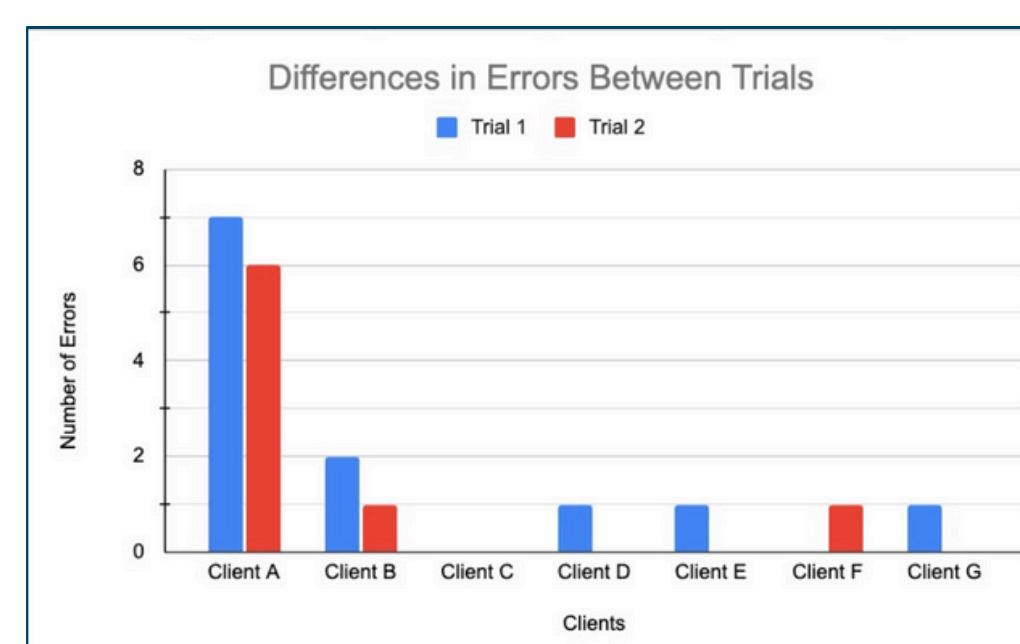


Figure 6: # Errors Between Trials

Similarly to Study 1, this study analyzed the **change in errors** made between trials. Almost all users made **fewer errors** in the second trial, indicating that they were able to **adjust** to the keyboard layout.

Conclusion & Future Work

- StepKeys provides a way for users with **limited hand/arm movement** to use a functional keyboard so they can type **without pain**.
- Adding **anti-slip material** to **enhance grip**

- **Optimizing** the **angle** adjustment piece on the back of the keyboard for users
- Creating the keyboard with a built-in **antibacterial material** so that it remains **clean**